وزارة التعليم العالي والبحث العلمي
الجامعة التقنية الجنوبية
المعهد التقني العمارة
قسم تقنيات المختبرات الطبية

الحقيبة التدريسية لمادة الكيمياء التحليلية العملي

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الصف الاول

تدريسي المادة

م.م لينا محمد زكي

الفصل الدراسي الاول

جدول مفردات مادة الكيمياء التحليلية العملي

Practical syllabus	
.Lab. No	Topics
1	.Type of glassware used
	.Cleaning solutions, safety
2	.Cation analysis
	.Unknown of cations. Quiz
3	.Anion analysis
	.Unknown of amnions. Quiz
5	.Balance, preparation of percentage solutions
	.Completion of preparation of percentage solutions
6	.Quiz, in balace and percentage solutions
7	.Preparation of normal solution and molar solution
8	.Dilution of concentrated solution
	.Quiz, examination in dilution
9	.Buffer solutions, preparation PH
	.PH. Meter
10	.Preparation of solution of known PH
	.Quiz , unknown
11	Volumetric analysis , acid-base. Titration. Preparation of standard borax. Solution
	. Quiz, unknown
12	Oxidation – reduction reaction. Preparation of potassium .permanganate
	.Quiz, unknown
13	Determination of ferrous ion. Percentage in cupper sulphate . solution. .Precipitation reactions
	.Quiz, unknown
14	.Colorimetry , photometers
	.Application of beers law
	Quiz. Unknown
15	Practical examination
	Practical examination

الهدف من دراسة مادة الكيمياء التحليلية العملي (الهدف العام):

تهدف دراسة مادة الكيمياء التحليلية العملي للصف الاول الى:

1) Use and clean laboratory equipment
2) . Can able to act with different chemical reagents
3) . Can able to prepare different concentration solution
4) Can be identify the biochemistry compound of

5) human being by using laboratory and chemically. methods
6) . Can able to use the laboratory instrument

الفئة المستهدفة:

طلبة الصف الاول / قسم تقنيات المختبرات الطبية

التقنيات التربوية المستخدمة:

1. الشاشة الذكية smart screen
2. عارض البيانات Data Show
3. جهاز حاسوب محمول Laptop

Lab No. 1
Title: Type of Glassware Used
Objective: To identify and understand the proper use of various types of laboratory glassware.

Materials:

Beakers (100 mL, 250 mL)

Erlenmeyer flasks

Graduated cylinders

Volumetric flasks

Test tubes

Pipettes (graduated and volumetric)

Burettes

Procedure:

.1Observe each piece of glassware provided.

.2Record the name, function, and volume range of each item.

.3Practice using pipettes and burettes with distilled water to understand accuracy and control.

.4Clean and store glassware properly after use.

Precautions:

Handle all glassware with care to prevent breakage.

Ensure all items are clean before and after use.

Do not heat volumetric or graduated measuring equipment unless it is specifically designed for it.

Lab No. 2

Title: Cleaning Solutions and Laboratory Safety
Objective: To learn the proper cleaning procedures for lab equipment and understand key safety practices in the laboratory.

Materials:

Detergent or cleaning agents (e.g., Alconox)

Distilled water

Brushes (various sizes)

Acetone or ethanol (if needed)

Safety goggles, gloves, lab coat

Waste containers (chemical and general)

Procedure:

.1Wear appropriate PPE (Personal Protective Equipment).

.2Rinse glassware with tap water to remove residues.

.3Wash thoroughly with detergent and brushes.

.4Rinse with tap water, followed by distilled water.

.5For greasy or stubborn stains, rinse with acetone or ethanol.

.6Air-dry or oven-dry the glassware.

.7Review the location and use of safety equipment: fire extinguisher, eyewash station, safety shower, and first aid kit.

Precautions:

Always wear safety gear.

Never mix incompatible cleaning agents.

Dispose of chemicals according to lab safety protocols.

Report any broken glassware or spills immediately.

Lab No. 3

Title: Cation Analysis
Objective: To identify the presence of common cations through qualitative analysis.

Materials:

Test tubes and rack

Bunsen burner

Droppers

Reagents: HCl, NaOH, NH_4OH, H_2S, flame test wires

Sample solutions (containing unknown or mixed cations)

Distilled water

Procedure:

.1Divide the sample into small portions in test tubes.

.2Add HCl to check for Group I cations (e.g., Ag^+, Pb^{2+}).

.3Add H_2S under acidic conditions for Group II cations (e.g., Cu^{2+}, Cd^{2+}).

.4Use NH_4OH and H_2S for Group III (e.g., Fe^{3+}, Al^{3+}).

.5Continue with appropriate reagents for Groups IV and V.

.6Perform flame tests for Na^+, K^+, Ca^{2+}, Ba^{2+}, etc.

.7Record observations (precipitate color, solubility, flame color).

Precautions:

Use fume hood when handling H_2S.

Avoid contamination of reagents.

Handle acids and bases with care.

Dispose of metal-containing waste properly.

Lab No. 4

Title: Unknown of Cations – Quiz
Objective: To identify unknown cations in a given solution using systematic qualitative analysis.

Materials:

Unknown cation sample

Reagents (HCl, H_2S, NH_4OH, NaOH, etc.)

Test tubes, droppers

Bunsen burner, flame test wire

Distilled water

Procedure:

1. Perform preliminary tests (color, solubility, pH).

2. Apply group separation techniques to identify the group of the cation.

3. Use confirmatory tests for suspected cations (e.g., flame test, precipitate reactions).

4. Compare results with known standards.

5. Record observations and conclude the identity of the cation(s).

Precautions:

Avoid contamination between tests.

Handle unknowns as potentially hazardous.

Use fume hood when required.

Clearly label your test tubes.

Lab No. 5

Title: Anion Analysis
Objective: To detect and identify common anions using systematic qualitative methods.

Materials:

Reagents: $BaCl_2$, $AgNO_3$, HCl, H_2SO_4, dilute and conc. acids

Unknown and known anion samples

Test tubes, droppers, water bath

Procedure:

1. Divide the sample and add HCl to test for carbonate (effervescence).

2. Use $AgNO_3$ to detect halides (Cl^-, Br^-, I^-).

3. Add $BaCl_2$ for sulfate detection (white precipitate).

4. Use concentrated H_2SO_4 and heat for phosphate and nitrate testing.

5. Confirm identity with color changes or precipitate formation.

Precautions:

Work in a fume hood when using concentrated acids.

Be cautious of toxic gases (e.g., NO_2, H_2S).

Dispose of heavy metal waste properly.

Lab No. 7

Title: Balance and Preparation of Percentage Solutions
Objective: To learn the accurate use of the analytical balance and preparation of percentage solutions.

Materials:

Analytical balance

Beakers, stirring rods

Distilled water

Solutes (NaCl, glucose, etc.)

Volumetric flasks

Procedure:

1. Calibrate the balance.

2. Weigh the solute accurately based on desired percentage.

3. Transfer solute to volumetric flask, dissolve with small amount of water.

4. Add distilled water to reach desired final volume.

5. Mix thoroughly and label the solution.

Precautions:

Avoid spilling solute while weighing.

Use dry glassware for accurate weight.

Ensure complete dissolution before volume adjustment.

Lab No. 8

Title: Quiz – Balance and Percentage Solutions
Quiz Questions:

1. Define weight/volume (w/v) percentage solution.

2. How many grams of NaCl are needed to prepare 100 mL of a 5% (w/v) solution?

3. Why is it important to use an analytical balance when preparing standard solutions?

4. What is the proper way to read a meniscus in a volumetric flask?

5. How would you prepare 250 mL of a 10% (w/v) glucose solution?

6. What precautions must be taken to ensure the accuracy of weighing?

7. If you mistakenly add extra solute, what can you do to fix the concentration?

Lab No. 9

Title: Preparation of Normal and Molar Solutions
Objective: To prepare accurate normal and molar solutions from solid reagents.

Materials:

Analytical balance

Volumetric flask (100 mL, 250 mL, 1 L)

Solutes (H_2SO_4, NaOH, Na_2CO_3, etc.)

Distilled water

Pipettes, stirrer

Procedure:

1. Calculate the required amount of solute using formulas:

Molarity (M) = moles / L

Normality (N) = equivalents / L

2. Weigh the correct mass of solute.

3. Dissolve in a portion of water in a beaker.

4. Transfer to volumetric flask and make up to the mark.

5. Mix well and label with concentration and date.

Precautions:

Use appropriate glassware and clean it before use.

Handle acids and bases with care.

Always add acid to water (never the reverse).

Lab No. 10

Title: Dilution of Concentrated Solution
Objective: To prepare dilute solutions from concentrated stock solutions using proper dilution formulas.

Materials:

Concentrated HCl or H_2SO_4

Volumetric flasks

Pipettes and pipette filler

Distilled water

Beakers, funnel

Calculator

Procedure:

1. Use the formula:
$C_1V_1 = C_2V_2$,
where C = concentration, V = volume.

2. Calculate the volume of concentrated solution needed to prepare the desired dilute volume.

3. Measure the required volume of concentrate using a pipette.

4. Transfer to a volumetric flask partially filled with distilled water.

5. Mix, then fill to the mark with distilled water.

6. Invert gently to ensure homogeneity.

Precautions:

Always add acid to water slowly.

Wear gloves and eye protection.

Label all prepared solutions with concentration and date.

Lab No. 11

Title: Quiz – Examination in Dilution
Quiz Questions:

1. What is the equation used for dilution calculations?

2. How many mL of 12 M HCl are needed to prepare 250 mL of 1 M HCl?

3. Explain why acid should be added to water and not the reverse.

4. If you have 5 M NaOH and need 100 mL of 0.5 M solution, what volume of stock solution is required?

5. Describe how you would prepare 1 L of 0.1 M sulfuric acid from 18 M stock.

6. What are possible errors in dilution procedures?

7. Why is it important to label diluted solutions?

Lab No. 12

Title: Buffer Solutions and pH Meter
Objective: To prepare buffer solutions and learn the correct use of a pH meter.

Materials:

Weak acid and conjugate base (e.g., acetic acid + sodium acetate)

pH meter and calibration solutions (pH 4, 7, 10)

Beakers, magnetic stirrer

Volumetric flasks

Distilled water

Lab No. 13

Title: Quiz – Buffers and pH
Quiz Questions:

1. What is a buffer solution, and how does it work?

2. Write the Henderson-Hasselbalch equation and explain each term.

3. How would you prepare an acidic buffer using acetic acid and sodium acetate?

4. What is the expected pH of a buffer containing equal concentrations of a weak acid and its conjugate base?

5. Why is it important to calibrate the pH meter before use?

6. What is the effect of dilution on the pH of a buffer solution?

7. Name two physiological buffer systems in the human body.

Lab No. 14

Title: Urine Analysis – Physical and Chemical Properties
Objective: To examine the physical characteristics and basic chemical components of urine.

Materials:

Fresh urine samples (synthetic or real with ethical consent)

Test tubes

Reagents for:

pH (litmus or pH meter)

Specific gravity (urinometer or refractometer)

Protein (sulfosalicylic acid)

Glucose (Benedict’s reagent)

Ketones (Rothera’s test)

Gloves, safety equipment

Procedure:

1. Physical Exam:

Record color, clarity, and odor.

Measure volume and temperature (if needed).

Test specific gravity and pH.

2. Chemical Exam:

Protein: Add sulfosalicylic acid and look for turbidity.

Glucose: Add Benedict’s reagent and heat; observe color change.

Ketones: Use Rothera’s test for purple ring formation.

3. Record all observations and compare with normal ranges.

Precautions:

Handle all biological samples with gloves.

Dispose of urine properly.

Do not smell urine samples directly.

Use appropriate PPE at all times.

Lab No. 15

Title: Unknown Urine Sample – Quiz
Quiz Questions:

1. What are the normal ranges for urine pH and specific gravity?

2. A urine sample turns Benedict's reagent orange after heating—what does that indicate?

3. What does a positive sulfosalicylic acid test indicate?

4. How can ketones be detected in urine, and what does their presence suggest?

5. What are the possible causes of cloudy urine?

6. Why is it important to test fresh urine samples?

7. What could a very high specific gravity indicate in a patient?
Procedure:

1. Calibrate the pH meter using standard buffer solutions.

2. Prepare buffer solution by mixing appropriate volumes of acid and salt solutions.

3. Measure the pH and adjust using small amounts of acid/base if necessary.

4. Record pH values and compare with expected theoretical value (Henderson-Hasselbalch equation).

5. Repeat for a basic buffer if time allows.

Precautions:

Rinse electrode with distilled water before and after use.

Do not dry the pH meter electrode.

Avoid touching the glass bulb of the electrode.

Lab No. 6

Title: Unknown of Anions – Quiz
Objective: To determine the identity of unknown anion(s) in a solution using qualitative tests.

Materials:

Unknown sample

All reagents used in anion analysis (HCl, $BaCl_2$, $AgNO_3$, etc.)

Water bath, test tubes, droppers

Procedure:

1. Treat the unknown sample with HCl and observe any gas evolution.

2. Use $BaCl_2$ and $AgNO_3$ to observe precipitate formation.

3. Perform confirmatory tests based on initial findings (e.g., solubility in NH_4OH or nitric acid).

4. Heat with concentrated acid to test for volatile products.

5. Record and analyze observations to deduce the anion.

Precautions:

Avoid skin contact with unknowns and acids.

Properly ventilate the area during volatile tests.

Do not mix reagents unless instructed.

مدة المحاضرة: 2 نظري 2 عملي

الأنشطة المستخدمة:

1. أنشطة تفاعلية صفية
2. أسئلة عصف ذهني
3. أنشطة جماعية (إذا تطلب الامر)
4. واجب بيتي
5. واجب الكتروني

أساليب التقويم:

1. التغذية الراجعة الفورية (التقويم البنائي).
2. اشراك الطلبة بالتقويم الذاتي (تصحيح اخطائهم بأنفسهم).

3. التغذية الراجعة النهائية (التقويم الختامي)، وهو حل الأسئلة المعطاة كنشاط صفي في نهاية المحاضرة.